

**REMARKS**

**The Amendments**

Claim 1 is amended to provide further details on how the amplitudes and phases of three-dimensional crystal structure factors can be determined directly from the Fourier-transformed data assuming weak topological object approximation. Support for provision of these details is found in the original specification, see, e.g., Example 1, pages 9 and 10, and page 6, line 4, to page 7, line 19, of the originally filed specification. As a further aid in understanding the invention, applicants submit herewith a schematic of the process which coincides with the recitation of the steps now literally recited in claim 1. Further, claims 1 and 8 are amended to correct obvious typographical errors.

It is submitted that the above amendments would put the application in condition for allowance or materially reduce or simplify the issues for appeal. The amendments do not raise new issues or present new matter and do not present additional claims. The amendments have been made to address the arguments made in the Final Office Action that the invention still does not recite steps which show a difference from the steps conducted in the prior art references. Further, the amendments address the new grounds of rejection made in the Final Office Action. They were not earlier presented because some of the rejections were first made in the Final Office Action and further because the arguments supporting the rejections had not yet been fully developed as they are now in light of applicants' supplemental information. Accordingly, it is submitted that the requested amendments should be entered.

The amendments do not narrow the scope of the claims since they recite steps which were believed inherent in the previous claim recitations, when read in light of the disclosure. The amendments should not be interpreted as an acquiescence to any objection or rejection made in this application.

To the extent that the amendments avoid the prior art or for other reasons related to patentability, competitors are warned that the amendments are not intended to and do not limit the scope of equivalents which may be asserted on subject matter outside the literal scope of any patented claims but not anticipated or rendered obvious by the prior art or otherwise unpatentable to applicants. Applicants reserve the right to file one or more continuing and/or divisional applications directed to any subject matter disclosed in the application which has been canceled by any of the above amendments.

**Objections to the Specification**

It would appear that all the objections to the specification are withdrawn. As requested, applicants have reviewed the substituted specification, previously submitted, and have no corrections to be made.

**The Previously-provided Supplemental Information**

Pursuant to the Examiner's request in the previous Office Action, applicants had provided supplemental information more specifically pointing out the nature of their invention and its distinguishing features. Although the current Office Action alleges that the information provided by applicants did not answer the questions posed, it concedes that the invention is now understood in light of the two articles provided by applicants supplement and the 35 U.S.C. § 112, first paragraph, rejection is withdrawn. Thus, although, the Office Action indicates the opinion that the invention is still not distinguished from the prior art – disputed below – it does appear that the supplemental information was sufficient to show that applicants' disclosure provides an adequate description of the invention under 35 U.S.C. § 112, first paragraph.

**The Rejection Under 35 U.S.C. § 102**

The rejection of claims 1 and 2 under 35 U.S.C. § 102(b), as being anticipated by Dorset ("Trends In Polymer Sciences" article) is respectfully traversed.

Initially, applicants point out that they disagree with the conclusion in the Final Office Action that applicants had previously misinterpreted the rejection recited in the initial Office Action. Applicants never stated that Dorset was distinguished because it is a "Direct Method" as understood from x-ray diffraction. Applicants' arguments clearly recognized that Dorset uses electron diffraction patterns from high resolution electron microscopy in its method. Thus, applicants take umbrage with the discounting of their arguments on the basis that they misinterpreted the rejection.

Dorset fails to describe unique determination of an atomic position and a surrounding molecular distribution inside a unit cell (hereafter, density distribution), which is the minimum unit describing a soft material, from TEM images without assuming a structural model. The Office Action points out the statement in Dorset "the Fourier transform of an electron micrograph would be the most easily **imagined** direct method" (emphasis added). While Dorset "imagines" such a method, it does not disclose such a method and, in fact, all the methods described in Dorset and in the "numis" webpage involved approximations and refinement of those approximations; i.e., trial and error type methods. The only actual methods discussed by Dorset are Cases 1-4 at pages 214-215. Each of these involve an educated guess at a model, making assumptions based on such model and seeing if the data fit the model. If they do not, another model is needed. This methodology is very evident in the method described in the "numis" webpage; see, e.g., the triangle schematic involving a "trial structure" and a "guess" step. There is no actual description in Dorset of any process fitting its "imagined" process wherein crystallographic phases are yielded after image analysis. The only reasonable interpretation from this disclosure of Dorset is that there was a

theoretical contemplation that such a method could exist but that Dorset did not provide any practical means to practice such a method. This matches closely with applicants discussion of the prior art in their original disclosure at pages 2-3. What Dorset fails to recognize and what provides a distinction of applicants' invention is that such direct structure determination can be made on soft materials because of certain assumptions that can be made as to soft material structure. That such assumptions can be made (e.g., low density of the soft material and the small dynamic scattering effect of electrons transmitted by a soft material, as further discussed in the following paragraph) and that they allow the direct structural determination without trial and error methods is part of applicants' invention that is unrecognized by the prior art. Dorset's methods do not involve determining the phase of the diffraction spots from the Fourier transformed data of the electron microscope image directly, i.e., by experiment and without assuming a model beforehand. Thus, Dorset does not anticipate the instant claims and the rejection under 35 U.S.C. § 102 should be withdrawn. Further, Dorset does not suggest the claimed method and would not support a 35 U.S.C. § 103 rejection either.

If soft materials give few diffraction peaks in powder X-ray diffraction then it is more advantageous to apply crystallography than tomography because that structural information will be distributed on reciprocal lattice points in a concentrated way, rather than in the whole wave vector space. Further, the structure of soft materials can be essentially obtained without need of atomic resolution but only with a resolution of about 10 angstroms. Important reflections of the diffraction pattern fall in a small scattering angle region of a few tens of angstroms. As recognized by the instant invention, these factors provide a physical background by which structural information can be obtained using only the TEM images, without the need of electron diffraction data. Thus, the structure determination can be made using a simple process involving only the following steps:

- taking TEM images of the soft material at a plurality of crystallographically significant directions as incident axes of electrons,
- converting the images to data into electronic form and Fourier transforming the data to obtain a two-dimensional Fourier diffraction pattern from each image,
- from the two dimensional Fourier diffraction patterns, making a distribution of diffraction intensities on the three-dimensional reciprocal lattice points and determining a unique space group therefrom,
- obtaining an origin point of space coordinates on the basis of the determined space group, and, thus,
- determining directly from the Fourier-transformed data the amplitudes and phases of three-dimensional crystal structure factors, the phases being directly determined assuming weak topological object approximation, and
- performing inverse Fourier transforms using the determined amplitudes and phases, to determine the structure of the soft material therefrom.

As a result of Dorset's above-discussed deficiencies, it also fails to disclose such method steps. Because Dorset does not recognize the assumptions that can be made, it cannot teach or suggest the process by which a unique space group can be provided from the from the two dimensional Fourier diffraction patterns and by making a distribution of diffraction intensities on the three-dimensional reciprocal lattice points. Dorset only speaks, in other than "imagined" ways, of potential solutions which must be tested against the predicted model.

For all of the above reasons, it is urged that Dorset fails to anticipate the instant claims and the rejection under 35 U.S.C. § 102 should be withdrawn.

**The Repeated Rejections Under 35 U.S.C. § 103**

The rejections of claim 3 and of claims 4-6 under 35 U.S.C. § 103, as being obvious over Dorset in view of Anderson (US Pub. 2002/0102674) or further in view of Subbiah (US Pat. 5,365,456) are respectfully traversed.

Applicants take further umbrage with the characterization in the Final Office Action that applicants' previous arguments merely attacked the references individually and did not address the combined teachings of the references. Applicants' undersigned representative takes personal umbrage with this allegation since it implies that he is not knowledgeable of the applicable law. Extreme care should be taken when making such serious allegations. A proper reading of applicants' prior arguments should leave no doubt that the combination of reference teachings was addressed and not merely their individual teachings. To wit, applicants' arguments recited "Anderson and Subbiah do not make up for the above-discussed deficiencies of Dorset or suggest modification of Dorset to arrive at the claimed invention" and went on to discuss the deficiencies of the secondary references which were also absent in Dorset, accordingly concluding both that "[t]he combined teachings of Dorset and Anderson do not suggest applicants' claimed invention" and "the combined teachings of Subbiah with Dorset and/or Anderson do not suggest applicants' claimed invention." Although the Examiner may disagree with applicants' interpretations of what the references teach, it should be apparent that the Office Action is incorrect in accusing applicants' representative of not addressing the reference teachings in the proper legal framework. It is urged that this allegation be explicitly withdrawn in response to this Reply.

Anderson and Subbiah were cited for their secondary teachings of applying the Dorset method to other types of materials. Applicants do not currently refute such application (although they reserve the right to later argue this). As applicants argued in the previous Reply, however, Anderson and Subbiah do not make up for the above-discussed deficiencies

of Dorset or suggest modification of Dorset to arrive at the claimed invention. Applying the method of Dorset to the materials taught by Anderson and/or Subbiah would still not result in or suggest applicants' invention because the steps of the Dorset method are distinct from those of applicants' method. Further, none of the references provide any recognition that, for soft materials, advantage can be taken of low density of the soft material and the small dynamic scattering effect of electrons transmitted by a soft material; compare page 3, lines 21-27, and page 6, lines 4-16, of the original disclosure.

For all of the above reasons, the rejections under 35 U.S.C. § 103 should be withdrawn.

**The New Rejections under 35 U.S.C. § 103**

The rejection of claim 8 under 35 U.S.C. § 103 as being obvious over Dorset in view of Koshishiba (U.S. Patent No. 5,051,585) and Coene (U.S. Patent No. 5,432,347) is respectfully traversed.

The Koshishiba and Coene references are cited for their secondary teachings to use a Wiener filter for high resolution electron microscopy. Applicants do not currently refute such application (although they reserve the right to later argue this). Applicants submit, however, that Koshishiba and/or Coene do not make up for the above-discussed deficiencies of Dorset or suggest modification of Dorset to arrive at the claimed invention. Applying the method of Dorset additionally using a Wiener filter would still not result in or suggest applicants' invention because the steps of the Dorset method are distinct from those of applicants' method.

For all of the above reasons, this rejection under 35 U.S.C. § 103 should be withdrawn.

The new rejection of claim 1, 2 and 7 under 35 U.S.C. § 103 as being obvious over Dorset is respectfully traversed.

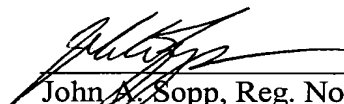
The Dorset reference is discussed in detail above and that discussion is incorporated herein by reference. As established above, Dorset does not provide any teaching or suggestion regarding the assumptions that can be made for structure determination of soft materials. It, thus, also fails to teach or suggest – other than in an undefined imaginary way – a method for unique determination of an atomic position and a surrounding molecular distribution inside a unit cell (hereafter, density distribution), which is the minimum unit describing a soft material, from TEM images without assuming a structural model. It certainly does not suggest any method involving the steps as recited in instant claim 1 to provide such a structure determination.

Accordingly, the new rejection under 35 U.S.C. § 103 should be withdrawn as well.

It is submitted that the application is in condition for allowance. But the Examiner is kindly invited to contact the undersigned to discuss any unresolved matters.

The Commissioner is hereby authorized to charge any fees associated with this response or credit any overpayment to Deposit Account No. 13-3402.

Respectfully submitted,

  
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John A. Sopp, Reg. No. 33,103  
Attorney for Applicants

MILLEN, WHITE, ZELANO &  
BRANIGAN, P.C.  
Arlington Courthouse Plaza 1, Suite 1400  
2200 Clarendon Boulevard  
Arlington, Virginia 22201  
Telephone: (703) 243-6333  
Facsimile: (703) 243-6410

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# *Process for 3d-structural solution of soft materials: silica mesoporous crystal from Electron Crystallography*

